

Cutting Edge Educators: Preservice Teachers’ Use of Technology within Universal Design for Learning Framework

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This qualitative study examined preservice teachers’ use of technology within a universal design for learning framework in an after-school academic support program. The researchers analyzed 135 journal reflections of 28 preservice teachers in a special education graduate program. Four themes emerged: (1) instruction, (2) engagement, (3) drill and practice applications, and (4) technical issues. The researchers found that for preservice teachers, incorporating technology in instruction requires sufficient time and opportunities for application. The discussion highlights the need for future educators to move beyond conventional instruction to explore and recognize the benefits and possibilities of technology integration.

With the passage of the No Child Left Behind Act, educators were mandated to use evidence-based instructional approaches and interventions to teach all learners. According to Dunst, Trivette, and Cutspec (2002), *evidence-based practice* is “informed by research in which the characteristics and consequences of environmental variables are empirically established and the relationship directly informs what a practitioner can do to produce a desired outcome” (p. 6). Documentation of evidence-based practice requires large-scale longitudinal research or multiple smaller scale studies which focus on the effectiveness of instruction that leads to improved academic achievement as measured by established benchmarks.

The NCLB legislation mandates effective instruction of diverse student populations. In order to provide quality education for all students, classroom teachers must look beyond customary practices. One instructional method, in particular, has been found to increase student academic success—the use of technology (Harrison, Lunzer, Tymms, Fitz-Gibbon, & Restorick, 2004; Hsieh, Cho, Liu, & Schallert, 2008).

Technology serves as a great equalizer, addressing social justice issues and empowering diverse students, including those with disabilities, by giving them access to twenty-first century competencies (National Council of Teachers of English, 2008). As preservice teachers learn to use technology in classroom

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instruction, they advance toward becoming the cutting edge educators needed in the schools today.

PRESERVICE TEACHERS AND TECHNOLOGY

The need for preservice teachers to strategically use technology involves moving from what Lambrecht (2000) called the *point and click* skills to the integration of technology into the curriculum and the application of technology in the problem-solving level of learning. Multiple strategies for technology use in classrooms include using basic operations, emerging technologies and modeling, as well as managing learning (Bitter & Pierson, 2005). Teacher preparation programs need to engage preservice teachers in technology-related activities that demand the integration of relevant content areas and collaborative problem solving in a work-like setting (Lambrecht, 2000). This elevates the skills of preservice teachers beyond simply *point and click* activities toward incorporating technology into instruction and curriculum in a way that allows them to provide maximum access for their students.

Gimbert, Bol, and Wallace (2007) suggested that fidelity and frequency of the application of instructional practices positively affects student performance in mathematics. As teachers are prepared in schools of education, they must learn how to (a) use technology, (b) synthesize appropriate research, and (c) make decisions about effective practice. Many challenges arise as teachers attempt to access evidence-based practice and make credible instructional decisions in the context of ideological conflicts between schools of thought about how best to teach exceptional learners.

Bitter and Pierson (2005) stated, "Teachers will find that the process of designing learning activities that integrate technology is very similar to designing traditional lesson plans" (p. 192). When teachers incorporate technology in their lessons, they increase student engagement and offer an alternative representation of the curriculum as well as options for students' expression of knowledge and skills. With practice and knowhow, many educators find that incorporating technology into lesson plans does not increase the time involved in preparation. It simply shifts the manner in which teachers plan instruction. For example, Universal Design for Learning (UDL) lesson planning provides teachers the planning vehicle for incorporating technology in instruction. Using this mechanism provides curricular access to all learners, including students with disabilities.

CONNECTIONS TO UNIVERSAL DESIGN FOR LEARNING (UDL)

Universal Design for Learning (UDL) refers to a research-based set of principles, which provide a framework for using technology to minimize curriculum barriers and maximize learning opportunities for all students (Rose & Meyer, 2002). UDL provides academic support for all learners, while specifically

addressing the needs of individual learners. Meeting the challenge of diversity, UDL fixes the curriculum, not the learner. Drawing upon brain research involving the brain's recognition strategic and affective networks to clarify student learning, UDL has the potential not only to increase access, but transform the learning process.

Educators who plan universally designed instruction depend upon flexible instructional materials, techniques, and strategies from the outset to meet the needs of the greatest number of users, making retrofitted curriculum differentiations unnecessary (McGuire, Scott, & Shaw, 2006). Teachers can provide students access to the general education curriculum by implementing instruction that reflects the Center for Applied Special Technologies' (CAST) principles of Universal Design for Learning: multiple means of representation, engagement, and expression. In teacher education programs, UDL can facilitate the instructional shift that preservice teachers must make in order to effectively implement technology to support student learning across the curriculum.

While some discussion supporting the implementation of UDL into higher education settings has emerged (Jimenez, Graf, & Rose, 2007), to date, limited research exists relative to preservice teachers' integration of technology in curricula and instruction consistent with UDL principles. While there is a body of research relative to technology integration and student achievement across the curriculum (Choy, Wong, & Gao, 2009), limited is the body of research that examines how preservice teachers use technology consistent with UDL principles.

PURPOSE

The purpose of this study is to examine the experience of preservice teachers' use of technology within a UDL framework during an afterschool academic support program. Researchers sought to determine the progress and challenges of preservice teachers as they shifted from a traditional instructional approach to an approach which incorporates the use of technology and UDL.

METHOD

Setting

As a component of teacher preparation at Hofstra University on Long Island in New York, the special education program maintains an after-school tutorial program for seventh- and eighth-grade students receiving special education services. In this context, preservice teachers in the graduate special education program work one-on-one with students with special needs in literacy and math.

University faculty members administer the program. The professors teaching the methods course incorporate the tutorial time as field experience and monitor weekly sessions. The district provides a special education coordinator and three chaperones that observe and log the strategies used in each in-

structional period. The district chaperones also provide the Hofstra faculty with feedback regarding what district teachers consider the specific needs of students and, therefore, serve as liaisons between the district and the university.

Participants

During the Fall 2009 semester, 28 graduate students in special education participated in the study. They ranged in age from 24 to 40 years old, and included 22 females and 6 males. The sample was predominately Caucasian, with one Asian student and one Hispanic student.

DATA COLLECTION

After each tutorial session, the preservice teachers wrote a reflective journal entry about the teaching and learning experience with focus on their instruction and interaction with the student with whom they worked. Each week the writings were emailed to the professor for feedback. Preservice teachers responded weekly to comments and/or questions from their professors.

Each of the 28 preservice teachers was expected to write seven journals over the course of the semester. Submission to the professors for feedback before the project due date was voluntary. Therefore, the total number of journals analyzed by the researchers was 135, less than the total required in the final portfolio.

RESEARCH DESIGN

The researchers chose a qualitative design in order to answer questions about how preservice teachers experience and think about integrating technology into a UDL instructional model. In education, qualitative researchers choose participants purposefully to illustrate meaning for a particular individual or to explore a social situation or experience (Bogdan & Biklen, 2003). This reasoning is aligned with Merriam's (1998) definition of qualitative research, which examined how people view, interpret and make meaning of the world around them.

In the current study, researchers independently read and re-read journal entries in search of preservice teachers' reflections on their use of technology during tutoring sessions. Topical coding of the journals resulted in the emergence of four recurrent themes that mentioned use of technology in teaching and learning: instruction, engagement, drill and practice applications, and technical issues.

RESULTS

Instruction

The majority of the preservice teachers discussed the use of technology in instruction. While at least six used technology without reflecting on its effectiveness or usefulness, 22 percent of journal entries directly addressed using

technology as an instructional method. It was seen as a means to address individual needs and interests of students or to make accommodations in order to access curricula. Technology was viewed as a part of Universal Design for Learning particularly as an additional form of representation of content and information with the use of pictorials. Preservice teacher M commented:

I started my lesson with [student] watching a video on Brainpop.com . . . then used Unifix cubes to [provide visual representations of] multiplication. I learned that a teacher should use different modalities to identify the best way a student can learn. She seemed to be a more concrete learner than a pen and pencil learner. The use of computer and games enabled her to understand . . . multiplication and see her progress. [Session 3]

Three preservice teachers wrote of their appreciation of technology in fostering higher-level thinking and the usefulness of technology as a means to coordinate content and information and instruction. While preservice teachers noted that the incorporation of technology could be difficult, they also commented on the effective technology in moving instruction beyond passive teacher lecture. The ability to expand instruction to graphically represent content and information was valued, particularly in the use of virtual manipulatives. Preservice teachers realized that finding the perfect resource is not always easy. Preservice teacher K's reflection indicated her challenges:

One thing that I found difficult for this lesson was the use of pie charts to represent fractions. I wanted to use a graphic representation in the lesson, but don't think I had enough time to properly include it. I tried to take a program from the computer and make it into manipulatives so that the students could see equivalent fractions. Unfortunately the intent of the activity on the computer did not translate. On the computer the girls would have been able to change the charts for different fractions. This was much more difficult to do hands-on with pieces of paper. [Session 4]

Engagement

Applications of technology such as the use of the SMART Board™ and virtual manipulatives were seen as important in both instruction and engagement. Preservice teacher N commented:

This lesson taught me the importance of technology. In an age where nearly every student has a cell phone or computer, it seems obvious that technology should be incorporated in daily lesson planning . . . watching how Gina

and Elise seemed more happy to participate and more engaged when using the SMART Board™ made me realize that using technology, when permitted, is advantageous to the success of students who have grown up in such a technology-packed time. [Session 5]

Thirty-six percent of preservice teachers emphasized the role of technology in engagement and motivation of the students with whom they worked. For preservice teacher K, interactive resources were valued for involving students, not their effectiveness in instruction:

I did use the computer in the beginning of the lesson to play a math jeopardy game which both girls enjoyed. It gave them a chance to work as a team to answer addition, subtraction and multiplication problems. They both did well and asked to do more work using the computer. [Session 1]

Fourteen percent of preservice teachers spoke of plans to use technology for instruction; however, these plans did not materialize in sessions. Preservice teacher D commented:

Next week, I plan to have at least two to three math websites that will address our lesson for that week . . . as her teacher [I] need to be ready to engage her in activities suited to the world of modern technology. [Session 2]

Some preservice teachers incorporated low-tech (manipulatives) and high-tech (on-line videos, games, manipulatives) resources as useful resources in their UDL lessons. Preservice teacher K commented:

Both girls expressed that they found it helpful to use manipulatives to visual [ize] the problem. They also liked showing their work on the dry erase board For my next lesson I am going to try to incorporate more computer work, whether it be watching a video or looking up “real world” information to create math problems. [Session 2]

Drill and Practice

Conventional use of technology is reflected in the application of computer activities for drill and practice, reinforcement, and reward. Three preservice teachers used on-line resources to glean graphic organizers, worksheets, and pictures to support their own representation of content. In these instances, students participated in paper and pencil tasks. Six of the preservice teachers used technology consistently but did not comment on its instructional role. Only one preservice teacher articulated her use of technology to assess a student’s prior knowledge on the topic of the lesson. Preservice teacher H demonstrates

clearly how technology was used for drill and practice with students, and not instruction:

At the end of our session we spent about five minutes on the computer playing a math game. It was a computation game and I think that these games are important because it reinforces their multiplication skills. I see that they are still using their fingers when they are multiplying [sic], so extra practice is needed to help them become more confident with their multiplication facts. From this session I was able to learn that the girls are not very confident with fractions. [Session 3]

Technical Issues

Lack of access to the Internet due to technical glitches disrupted lesson plans and reinforced insecurities that developed from depending solely on technology for instruction. The actual nature of websites, the need to vet them, and the limitations of certain sites for instruction purposes were noted. One preservice teacher sought to use websites during her first session with students. After incorporating Tony's Pizza website into her first math lesson, she realized why the site was challenging:

In regard to the website, if there were a way to slow down the game that would have been the best thing for us. If it were a program on the computer it could be left open ended which would give us the time we needed to discuss and solve for at least three of the problems. [Session 2]

Preservice teacher J remarked on the need for vetting websites: After answering approximately 15 on-line questions on the ixl website the site told me I was maxed on questions . . . allowed for one day and would not let us practice anymore. That was unfortunate because Shirley seemed to enjoy working on the computer to solve math. That is one disadvantage of free on-line resources I suppose. [Session 3]

Student response to resources also emerged as a challenge. Preservice teacher B's attempts at using a video clip to teach math concepts led her to abandon the on-line technology for low-tech manipulatives:

As we began the session I showed the girls a YouTube video which they were not interested in at all on mean, median and mode. The video itself had a cartoon character and a catchy tune but they were too cool for it, so I bagged it and we began the next part of the lesson. At this point I gave them a mini lesson on mean, median and mode and introduced the measuring tape to take arm length data to

create a number set and look for mean, median and mode.
[Session 5]

DISCUSSION

Although the need to change traditional instructional approaches is consistently validated in the literature (Anyon, 1981; Brophy & Good, 1986; Cuban, 1990; Delpit, 1988; Spillane & Jennings, 1997), the actual process of change is another matter. The research findings in this article highlight the difficulty in making the shift in instruction. Preservice teachers draw on their personal educational experience and the instructional model presented in coursework. The findings of this study supported Lambrecht's (2000) results on the reliance of *point and click*. This is evidenced here by preservice teachers' use of technology in peripheral ways of instruction, such as accommodations, alternate forms of representation, practice, and application. In a more limited fashion, the computer time was used as a reward or as a tool for practice before and after instruction. In addition, some preservice teachers showed insecurities in the value of the websites for instruction, the reliability of the actual technology for instruction, and the limitations of computer versus teacher-directed learning.

It is also significant to note that preservice teachers saw a social aspect to the use of technology. It served as a means for collaboration on projects and was used in peer tutoring. Both of these social issues directly relate to instruction, although the preservice teachers did not view these strategies from that perspective. At the same time, a number of preservice teachers that appreciated the potential for technology in instruction pointed out how it helped support higher-level thinking and interactive learning. The usefulness of technology for teacher instruction and organization of content was also mentioned. These implications indicate a more sophisticated appreciation of technology by a few of the preservice teachers.

The move to the use of technology for instruction is felt to be difficult and time-consuming, reinforcing the findings of Bitter and Pierson (2005). Reflections indicate time and practice are important to acclimation to various technological resources and versatility in usage. The demands of weekly planning for real instruction with real students can nudge preservice teachers past the *point and click* stage of technology usage toward more integrated approaches to learning and technology within the UDL framework. One preservice teacher in the study said, "Shifting my thinking to really understand the multiple means of representation, engagement, and expression has been one of the most difficult things for me and today I finally saw firsthand how important those skills are."

The comments of the preservice teacher demonstrate just how long the transition to the use of technology in instruction can take. "This was the first week I showed an online video and I think it went really well. The students liked

to watch the clip and it was very engaging The students really enjoyed the online video clip.” [Session 6] After five weeks of the tutorial another preservice teacher noted with pride, “I am implementing the computer more and more.” Both of these comments came well into the seven-week tutorial program and demonstrate that the conversion to the use of technology required more reflection and experience. In this study, since the majority of preservice teacher did not use technology for instruction, we must assume that seven weeks is not long enough to make the transition.

One group of preservice teachers noted that technology would have enriched the experience. However, they did not employ its use in future lessons. Another group of preservice teachers did not mention or reflect on the use of technology in their lessons at all. This group of preservice teachers did not seem to discern any appreciable “added value” in the use of technology. This suggests the need to embed the use of technology for instruction early and consistently in the teacher education program. By doing this, the preservice teacher will have a heightened appreciation and ability to use technology.

CONCLUSION

As we prepare preservice teachers for the 21st century, the call for best practice must be operationalized. An awareness of what best practice means is crystallizing to include all learners. Lee, Wehmeyer, Soukup, and Palmer (2010) discussed the need for curriculum adaptations and augmentations in order for students with disabilities to access general education curriculum. They referred to adaptations, specifically UDL, as a means to design curriculum that is accessible without the content being altered. The results of their study indicated that there were no augmentations—additional skills to help a student succeed in the general education curriculum without altering content—for students with disabilities, and that accommodations were overwhelmingly in the form of paraprofessional presence, but no active support. These findings undergird the need to employ current best practices. The use of technology and the incorporation of UDL in instruction meet that need. This reiterates how essential it is to rethink the strategies and instructional approaches that are taught in teacher preparation. If we, as educators, want our classroom to provide optimal instruction for all students, we need to make sure that our future teachers have the preparation they need to be cutting edge.

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